This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

600005419P

29-12

THE

SCIENCE OF MUSIC.

BY

W. BALDWIN.

LONDON:
GEORGE SWIRE, NORFOLK STREET.
1829.

LONDON:
PRINTED BY SAMUEL BENTLEY,
Dorset Street, Fleet Street.

ON MUSIC.

INTRODUCTORY CHAPTER.

THAT Music is a science, no one can doubt; that, as a science, it is subject to rules, which rules must accordingly depend upon some principle, will be evident to every one who can hear a piece of music with pleasure, and reflect for one moment upon the cause of that pleasure.

Such was my conviction when I first turned my attention to the study of Thorough Bass;

but the manner in which I found it treated by its professors, convinced me that, in its present state, there is nothing like science about it. I was certain that the principle upon which it depended, must be very simple, and the rules proceeding from this principle, few, certain, and capable of clear definition; instead of which I found no principle whatever noticed, no reason, no cause assigned for any one rule, and the rules themselves so complex, voluminous, and uncertain, so vague and unsatisfactory, that the term Science appeared ironical when applied to it.

The very data or position that musicians assume, and by which their rules are explained, appears, by their own showing, to be erroneous. I shall notice the difficulties I met with, in taking a sketch of the science as it at present exists, before I proceed to the discussion of the subject.

I found the first datum, which was assumed as an essential, (without any reason being given

for such assumption,) was, that it was requisite to have seven notes in each key, which notes were to be placed at certain distances from the key-note, and which distances are as follows; for instance, in the Natural Key, the notes are C, D, E, F, G, A, B, C; from C to D is a whole tone; from D to E, a whole tone; but from E to F, only half a tone; from F to G, a whole tone; from G to A, a whole tone; from A to B, a whole tone; and from B to C, half a tone; that is, the distances between E and F, and between B and C, are only half as much as between the other letters or notes. The distance between C and its corresponding octave, was six whole tones, or twelve semitones; and of these, the second, fourth, fifth, seventh, ninth, eleventh, and twelfth, were selected as harmonizing or belonging to the key-note; the other were discordant, and did not harmonize.

There is no reason, as I before observed, given for this arbitrary selection of tones and

half-tones; but its apparent whimsicality infers,—nay, proves,—that some principle must exist, on which this selection is made, especially when we are informed that all the keys are to be formed in the same manner; that is, in each key there must be the same arrangement of notes as to tones and half-tones, from the key-note, so that the notes which are discordant in one key will harmonize in another; and as there are twelve notes, and each might be taken as a key-note, there would of consequence be twelve keys, in which Music could be written.

This, then, I supposed, contained the true system of Music; and I came to the conclusion, that if I could discover any principle by which this selection of notes in a key was made, that that principle would afford me plain rules, by which I might be enabled to account for, and also to construct harmonies and melodies.

In No. 234 of the Spectator, I found the following:

"Who would have thought that the clangorous noise of a smith's hammer would have given the first rise to music? Yet Macrobius, in his second book, relates that Pythagoras, in passing by a smith's shop, found that the sounds proceeding from the hammers were more grave or acute, according to the different weight of the hammers."

This induced me to think of the possibility of reducing all the notes to a repetition, variation, or modulation, of or upon one note, which occurring at stated intervals, the beginning of each bar, would clearly show the connexion that exists between the present system of music and its former origin.

I was further led into this train of investigation by finding, that on every wind instrument the same fingering was used for the note, and for its octave,—in fact, that they were the same note: I moreover found that the fifth also might be produced with the same fingering; and this proved that the fifth was merely a modulation of the same note.

As this was the nearest related to the key note, except the octave, and as I could find no other note at all connected with the key, I took this as the ground-work of my proceeding out of twelve semitones: The fifth of C was the seventh semitone G; the fifth of G was the fourteenth semitone; reduced to its octave, was the second semitone D; the fifth of D was the ninth semitone A; the fifth of A was the sixteenth semitone reduced to its octave, fourth semitone E; the fifth of E was the eleventh semitone B; the fifth of which would be the sixth semitone F sharp. I therefore took the fifth below, or the note of which C was the fifth, and which is the fifth semitone, or F natural. This completed all the notes in the key, avoiding all the discords; and upon this I constructed the following table of all the keys:

			Semitones		1 sharp	2 sharps	3 sharps	4 sharps	5 sharps	6 sharps	5 flats	4 flats	3 flats	2 flats	1 flat	Natural K	Semitones
					*	**	** *	** **	*** **	*** ***	bbb bb	bb bb	bb b	bb	b		
The Key-note D . .		C		$\frac{1}{5}$th of C is G	G	D	A	E	B	F*	Db	Ab	Eb	Bb	F	C	b
			1	$\frac{1}{5}$th of G is D													1
re	3	D	2		A	E	B	F*	C*	G*	Eb	Bb	F	C	G	D	2
			3														3
1st Harm. or mi $\frac{1}{3}$	5	E	4	Mediant	B	F*	C*	G*	D*	A*	F	C	G	D	A	E	4
fa	0	F	5	Sub-dominant	C	G	D	A	E	B	Gb	Db	Ab	Eb	Bb	F	5
			6														6
2d Harm. or sol. $\frac{1}{5}$	2	G	7	Dominant	D	A	E	B	F*	C* or Db	Ab	Eb	Bb	F	C	G	7
			8														8
la	4	A	9	Sub-mediant	E	B	F*	C*	G*	D*	Bb	F	C	G	D	A	9
			10														10
	6	B	11	Leading Note	F*	C*	G*	D*	A*	E*	C	G	D	A	E	B	11
ctave or Unison . .		C	12	Tonic	G	D	A	E	B	F*	Db	Ab	Eb	Bb	F	C	12

But when I came to apply the principle that I thought I had discovered, I harmonized G with C: this was right. I then added D as the next fifth, expecting this would harmonize too; but it proved a discord; whilst the E, which was four degrees by fifths from the key note, harmonized with it. It was very clear, that this principle of proceeding by fifths was insufficient, if not altogether incorrect.

I therefore kept the above table only as a table to transpose from one key to another, and to show the relative harmonies in the different keys at one view; and applied myself to the study of intervals, on which the system is at present constructed. The first note D is called the second; the E flat, the third semitone, is called the minor third; E, the fourth semitone, the major third; F, the fifth semitone, is called the fourth; G, the seventh semitone, the fifth; A, the ninth semitone, the sixth; and B, the eleventh semitone, the seventh.

The key-note C harmonizes with its third

and fifth, E and G. The fifth of the key-note C harmonizes with its third and fifth B and D; and the fourth of the key-note, or the note of which C is the fifth, harmonizes with its third and fifth, A and C. These are the three principal chords: C, E, G, the common chord; G, B, D, the chord of the dominant; and F, A, C, the chord of the subdominant. There are also four other common chords, making seven Triad harmonies, each of which, by being inverted in three separate positions, gives twenty-one variations, each of which must be studied, as their effect is various; they are subject to rules concerning wide, or dispersed harmony; then come chords of the sevenths, which are seven, one to each of the above, with all their inversions and combinations; after which come the chords of seconds, thirds, and fourths, fifths, and sixths, with all, each, and every of their inversions and combinations.

This is the major key of C, and there are about five hundred examples to be studied in

this alone. After this comes the minor key, with an equal number of notes, and harmonies with their several relations and combinations, equally voluminous to be learned, practised, and studied; and then the material with which you have to work is ready. You must then study the transformation of chords, the suspension of chords, the anticipation of chords, and these all by examples, not general rules; then come harmonic and inharmonic intervals, and then harmonic ambiguity, which is divided into two parts, and which leads to the affinity of tonics and scales; and then comes the system of modulation perhaps into other keys, which will involve ten times the study mentioned above. [This course is taken from Gottfried Weber's Theory of Musical Composition, one of the latest and most approved works on the subject.]

Here is a great deal to be learned and to be studied; but the knowledge is valuable and the reward ample; and when the natural key is well studied with its seconds, thirds, fifths, and its

chords, its inversions, relations, and combinations; when their transformations, suspensions, and anticipations, with their ambiguities and affinities, are thoroughly impressed upon the mind of the student, the little table before given will immediately give him in any other key the relative chords' inversions, up to their ambiguities and combinations, and the whole science will be laid before him. No such thing. I am sorry to say, this is only the beginning of his labours, and which I trust to prove to him most clearly and satisfactorily.

The first proof I shall offer is, that an air, impressed with the character of the key in which it is written, cannot be transposed into another key, and preserve the same effect: now, the key-note being only the height at which the music is pitched, this could not be the case unless there was a difference in the relative proportions of the intervals or notes. The second proof is, that D flat and C sharp are different notes. The D flat is obtained by

descending by fourths; the C sharp, by ascending by fifths, and are played differently on instruments of the violin class, in different keys, though it is the same note on the piano. The third proof is, that on tuning the piano there exists what is called the Woolff,—an imperfection in the instrument, by which only the keys to three sharps and three flats can be made perfect.

Now, if the twelve semitones were all at equal distances, any tune, with its harmonies, would transpose and have the same effect; but this is not the case. Again, if these semitones were equal, the D flat and C sharp must be one and the same note—but they are not so: and farther, if these twelve intervals were alike, the piano would be perfect; for the piano has twelve notes in each octave, which might easily be tuned at equal distances, and the instrument made perfect—but this cannot be done. What then is the conclusion, but

that these semitones, or intervals, are not all equal?

Now, suppose one to be unequal, the interval to be longer than the rest, to make the notes in the natural scale perfect: when these notes are transposed into a different key, the inequality must occur in a different part of the scale, and must thereby change their relative proportion to each other. What will the reader think when I inform him, that not only one is unequal, but that there are scarcely two alike, either amongst the tones or semitones; that, consequently, the relative harmonies in each key are different, and the melodies also in most of them, and it is this difference which gives a distinct character to each key?

If the reader would wish to wade through twelve different keys, with their chords and their inversions, relations, combinations, &c. up to their ambiguities, according to the system mentioned above, he has more nerve than I

possess:—if, on the contrary, he feels a fear of encountering such an Herculean task, I hope this fear, this doubtful prospect of the science, may act as an inducement with him to give me his whole undivided attention,—his anxious and patient study, in the investigation of one single principle,—the principle upon which sounds harmonize together; and that, even if he does not see the exact result to which it leads, he will not leave this study until he has thoroughly satisfied his mind on the nature of it; and then I will give him one rule formed on this principle, for the formation of harmonies and melodies, and one rule for the formation of discords, by the help of which two rules, he will be able to write melodies himself, to harmonize the proper notes to those melodies, to tell what will be the effect of any two or three, or more notes, sounded together on the piano, quite as correctly as the most scientific musical composer; he will be enabled to

form new arrangements of harmonies in the different keys, to understand the different character of each key, and why that difference in their character exists, and, in short, to know the whole science of Music.

CHAPTER II.

ON THE SCIENCE OF MUSIC.

As Music is nothing but sound, it may not be impertinent to become acquainted with the nature of sound, before we inquire how that sound becomes musical, and why different sounds harmonize together.

The air, through which sound is conveyed, is a fluid which fills every part of the world,—philosophers allowing of no such thing as a vacuum. This air presses with a great weight (about fifteen pounds, on a square inch) on every part of the body; and if we do not perceive this weight, it is because the

weight presses equally on every side, on the inside as well as the outside, and we remain, as it were, balanced in it. This pressure exists, of course, as heavy on the ear as on the other parts of the body; and the ear being constructed in a peculiarly delicate manner, any commotion which takes place in the air is felt or perceived by the ear: this commotion is called sound—this perception is called hearing.

The aerial fluid is so subtle, that a body can pass through it without causing any commotion, just as your hand may pass through the water in a basin without throwing it about; but if one body, passing through the air, strikes against another body, the air is forced from between them, and causes a commotion in the atmosphere; the same as the hand, in passing through the water, if it were to strike against the side of the basin, would splash the water about: this commotion would be perceived by the ear, and would be called sound.

This is proved by the fact, that a bell will

not sound under an exhausted receiver, that is, in a vacuum where there is no air: "Campanulam in spatio aëre ut putant, vacuo suspensam sonum nihilominus edere, ex Kircheri observatione refert autor." "In recipiente sub ipsa aëris exantlatione sonum bilibris in horologio paulatim decrevisse atque demissiorem factum fuisse; adèo ut tandem non ampliùs potuerit percipi, licet motus ipse in horologio non cessaret; ac intromisso denùo externo aëre sonum iterum fuisse auditum."—(Deusingii considerationes circa experimenta illustris equitis Roberti Boylei,) 1662.

The cracking of a whip will also prove this; for there is no sound in the bit of silken lash that cracks; the sound, therefore, must be in the air; and it is caused in this manner: the lash is thrown out, and the force of a long lever, a strong spring in the stock of the whip, and a sudden jerk in the arm, all combining, draw the lash back so suddenly, that the portion of air which the lash curls round is drawn away with

it: a vacuum is formed, and the body of air on each side rushes suddenly together, and causes the crack; if the lash were thick, it would require the arm of a giant to crack it—a crack similar to this is caused by lighting a bubble of oxygen and hydrogen gas: this causing a vacuum in the air, the body of air on each side rushes together, and this motion of the air is perceived by the ear, and is called Sound.

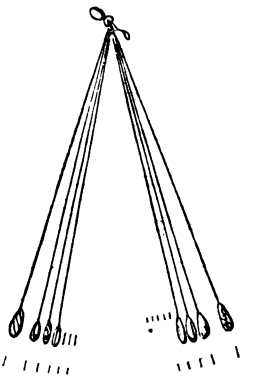
Having got, as I hope my reader has got, a just and true conception of the nature of sound, that it is only the motion of the air which is perceived by the ear, and that the difference in this sound is loud, or sharp, or low, as the air is suddenly and violently moved as by a cannon, or quickly as by a whip, or gently, or in any other of the thousand ways in which it may be moved; we will now proceed to consider what constitutes a musical sound.

A musical sound is a sound produced and continued at equal distances of time: if the air

is moved, it causes perception; if the air is moved at regular periods, it causes not only perception, but pleasure, or a musical sound. It is the perception of this regularity that causes the pleasure, or the music;—in short, the sense of hearing is called into action in the most agreeable manner.

Let the reader strike a string on the harp; there is a fresh motion in the air, a new sound produced at every vibration of the string: that these sounds or vibrations are at equal distances, at first, no one can doubt: the string is sprung back by an equal tension at each end, and consequently the distance between the sounds must be equal. The question is, whether it continues to vibrate at the same equality of distance as it moves slower and as the sound diminishes.

This I shall prove to be the case by the following experiment:



Take a pendulum that vibrates once in a second, and set it in motion; it will move quick at first, and gradually move slower until it stops, exactly like the harp-string; but observe, as it moves slower, it takes in a less sweep, and does not move so far; and if the watch is examined, it will be found that exactly a second elapses between each vibration, until it stops; a second elapses at the beginning,

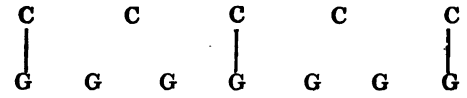
when it is going quick; and a second elapses at the end, when it is going slow; and so it is with a musical string; if there are a hundred vibrations in a second at the beginning, there are still a hundred vibrations in a second at the end; there is still the same regular continuity of sound, the same distance observed between the sounds, though the string moves slower, takes a less sweep, and strikes the air less forcibly as the sound diminishes and dies away.

On this *regularity* depends the whole science of Music; and of course I should wish my reader to satisfy his mind, that this regularity exists from the beginning of the sound to the end; or it will be impossible for him to understand thoroughly the inferences drawn from it, the system constructed upon those inferences, and the rules deduced from that system. He can convince himself by a piece of string, with a weight hung up to a nail. If he observes it carefully, after it is set in

motion, he will find, as it decreases, that the same time takes place between the vibrations at the end, as at the beginning. I may seem more anxious than the subject appears to demand about this point; but the reader must understand this clearly, before we can take another step; if he does understand it, he will see why a string, whether struck piano or forte, produces the same pitch or tone, or, in musical phraseology, the same note.

The number of times that a string will vibrate in the course of a second cannot be exactly ascertained; but this, as we can easily obtain the average vibrations between strings of the same thickness and different lengths, will not be of any consequence. We will, therefore, suppose, that the note C vibrates one hundred times in a second; a string half that length will consequently vibrate two hundred times in the second, and will produce the octave of C; G, the fifth of C, is formed by taking two-thirds of the string; consequently G will vi-

brate three times, whilst C vibrates twice, and one hundred and fifty times in the second; fifty of which vibrations will be in unison with the vibrations of C, and the other one hundred placed at equal distances between them, for instance:—



And this is harmony:—If the vibration of a string at equal distances produces the pleasure which a musical sound does, what must be the effect of two strings, each vibrating at equal distances, each musical, and each blending, varying, and supporting one another? Must not the effect be such as is produced by harmony?

Would not Pythagoras, when he invented music, have expected such an effect to have proceeded from such a cause? Would not any one else expect the same effect? And when this effect is proved by experiment to be such

as would naturally be expected, can there be the least doubt remaining that this is the cause of harmony?

There is but one point on which it is possible to have a doubt; and that is, that although G, the fifth, is two-thirds of the string, it does not follow that it should vibrate three times, whilst C vibrates twice. This I have proved by actual experiment; for, by setting two pendulums in motion, one two-thirds as long as the other, the fact appears at once. And this fact is one of no slight importance; for by this, on ascertaining the relative length of the strings by which the notes are formed, the relative number of vibrations which they make in the same time, can be easily ascertained, and notes can be concorded and discorded, modulated, and melodized, by the most simple calculations, and with more certainty than by the finest musical ear that ever was formed.

Here then is the clue that is to lead you

through this labyrinth of chords, inversions, suspensions, anticipations, combinations, and ambiguities; here is one single principle, which, if carefully studied, shall not leave a difficulty, whether under the denomination of chord inversion, suspension, anticipation, combination, or ambiguity, remaining in the science.

To find the different lengths on the string by which the notes were formed, in order to ascertain their relative vibrations, I procured instructions as to the mode of tuning the piano-forte. It was effected by nineteen different operations.

First Operation.—Tune the middle C to the pitch-fork.

Second.—Tune to the C already tuned, G, its fifth above.—The fifth is formed by taking two-thirds of the string; this is the situation of G.

Third.—Tune E between the above notes to make the common chord of C major; this is

called the third, and its place on the string is four-fifths.

Fourth.—Tune to the G, D its fifth above. —G is two-thirds, multiplied by two-thirds, makes four-ninths; but this will be the octave D, which is only half of the note; double it, and eight-ninths, the true situation of D is ascertained.

Fifth.—Tune B between the above notes as thirds to G; G is two-thirds, multiplied by four-fifths to get its third, makes eight-fifteenths, the situation of B on the string.

Sixth.—Tune to D, A its fifth above. D is $\frac{8}{9}$ × by $\frac{2}{3}$ makes $\frac{16}{27}$.

Seventh.—Tune F sharp between the above notes as third of D.—D is $\frac{8}{9}$ × by $\frac{4}{5} = \frac{32}{45}$, the situation of F sharp.

Eighth.—Tune to the A, E its fifth above.—A is $\frac{16}{27}$ × $\frac{2}{3}$ = $\frac{32}{81}$, this is the octave E, × by 2 = $\frac{64}{81}$.

"Now," says the piano-forte tuner, "compare this E with the E tuned in the third

operation as the harmony to the common chord. If they are perfect, all is right; if not, you must try and make them so." And now I also say, compare the E produced by fifths, with the natural harmony to the key. Is $\frac{64}{81}$ = to $\frac{4}{5}$, 64 divided by 16 = 4—81 divided by 16 = to 5, and one over?—Here is one over.

A question will naturally arise, why is E the harmony to C and G? and why is C, E, G the natural chord, whilst C vibrates four times? E being four-fifths, will vibrate five times; and G being two-thirds or four-sixths, will vibrate six times, each string uniting at the fourth vibration of C. But we are informed that C, G, c, e octaves, is the most harmonious arrangement; for why? because then, whilst C vibrates twice, G vibrates three times, c octave four times, e octave, five times. And all their vibrations would be in unison with every second vibration of C; so that the reason, why E as four-fifths was requisite to fill up the har-

mony, appears very clear; but why do they want to get at it by fifths? It is to make the other keys perfect. G, the fifth of C, must have its fifth D, which must have its fifth A, which must have its fifth E, for, if the note has not a fifth, the key of that note is imperfect. G is $\frac{2}{3} \times$ by $\frac{2}{3} = \frac{4}{9}$, D or $\frac{8}{9} \times$ by $\frac{2}{3} = \frac{16}{27}$, A $\times$ by $\frac{2}{3}$ $\frac{32}{81}$ or $\frac{64}{81}$, which is not four fifths, and would spoil the natural harmony of the key.

The tuner has got the key of C perfect, and he wants the other keys perfect too. "You must see," says he, "if you can mend them, without spoiling the one as third to C, or the other as fifth to A;" and if he can, he will be entitled to the highest praise.

Any body who has looked at these calculations, must see in a moment that the thing is physically impossible. What then must be done? The tuner will not spoil the natural key and first concord, as he would be detected

directly; he, therefore, throws the woolf, or imperfection, on the keys above A, and the keys below E flat, and which keys are called imperfect: this shows that there must be a totally different arrangement of harmony and melody in those keys from the natural key; and which difference of harmony, of melody, and of character, will be as easy to form, to arrange, and to discover, as it is to add two and two together.

The explanation that this system gives of the imperfection in the piano, is a very fair proof of its correctness; but its applicability to every purpose of Music will preclude the necessity of proof.

I will not detain the reader by going through all the calculations by which I got the relative situation of each note on a given string, but proceed at once to give him the result of my labours, and the Tables I formed upon them.

C is supposed to be one.

C sharp is twenty-four twenty-fifths of the string.

D is eight-ninths, as we have seen before.

E flat is six-sevenths.

E is four-fifths.

F is three-fourths.

F sharp, five-sevenths.

G, two-thirds.

G sharp, sixteen twenty-fifths.

A, three-fifths.

B flat, nine-sixteenths.

B, eight-fifteenths.

C, the half.

CHAPTER III.

I OWE this ingenious arrangement of my calculations of the different relative vibrations of the notes to my friend, Mr. Frank Howard, to whose demurs, doubts, and difficulties, as well as to whose patient and persevering investigation, the present system is much indebted.

The vibrations in the key of C.

C — 9
F —12
Ab—14
A —15
Bb—16
c —18

Key of F.
F — 4
A — 5
C — 6
Eb— 7
F — 8
G — 9
A —10
B —11
c —12

c —12
Eb—14
E —15
F —16
G —18
A —20
c —24
Db—25
D —27
Eb—28
E —30

Key of A.

c — 6
c — 6

Chord of the Subdominant.

Vibra.
C—1
c—2
G—3
c—4
E—5
G—6
c—8

Common Chord.

G—4
B—5
D—6

Key of G.

E — 5
G — 6
C — 8
D — 9
E —10
c*—11
G —12
B —15
C —16

Chord of the Dominant.

Derivative Chord.

G —12 or 4
B —15—5
c —16
D —18—6
E —20—4
F*—22
G —24
G*—25—5
F —30—6
B —32

Key of G.

Key of E.

From the numbers of vibrations opposite the common chord, will be seen not only the different inversions which may be made in that chord, but the harmonious value of each of those inversions,—2, 3, 4, 5, C, G, c, e, being of course more harmonious than 4, 5, 6, C, E, G;—and again, C, E, G, 4, 5, 6, will be more harmonious than E, G, C, 5, 6, 8.

The first derivative chord introduces D, the discord of the fifth being the nearest to the key; and the second derivative chord, shows clearly not only the nature of ambiguities, and how notes may belong to either one key or the other, but the true system of modulation from one key to another.

Any body then can calculate from this table which are the best harmonies to select, how perfect those harmonies will be, the notes that naturally lead to those harmonies, how they lead to them, and why they lead to them.

Knowing all this, would not those who wished to afford themselves or others pleasure

through the means of musical sounds, strike not only the simple note but harmonize other notes with it? Would they not also vary this harmony, and this arrangement of harmony, in the thousand ways in which it may be varied? and when they found this affinity of the notes getting beyond the recognition of the ear, would they not, to prevent this, let the different harmonies occur at regular periods, that the ear might be prepared for them and expect them?

This is exactly what a person would do who did not know what Music was, but who understood the reason why musical sounds were pleasing, and why different musical sounds harmonized together, and who wished to make these sounds as agreeable as possible; and this is exactly what a musical composer would do if he wished to compose a piece of Music: and thus we have the art and the science united.

We have now seen that harmonies are notes whose vibrations are in unison at certain stated

times; as C 4, E 5, G 6, all vibrate together every fourth vibration of C; that is, the fourth vibration of C, the fifth of E, and the sixth of G, all sound at once. Again, C 3, F 4, A 5, harmonize their vibrations—are in unison at every third vibration of C. And all the other harmonies in the key are more or less perfect, as they vibrate together at the fourth vibration, at the eighth, at the ninth, or at the sixteenth vibration. We have also seen why musical sounds produce pleasure; why different musical sounds, harmonized together, produce more pleasure; how variations on their harmonies can be formed; why these variations can be carried farther, and varied more, if they occur at stated times; and how any air or measure founded upon this arrangement of harmony, constitutes Music.

It being the intention of the Author, for several reasons which will be stated hereafter, to confine this work solely to the science of Music, his task would naturally end where the

connexion between the science and the art first became apparent; and he would leave the student to proceed by the force of his own talent, perseverance, and patience in the application of this science towards the perfection of his art, and in which application he would proceed as follows:—he would find that there are harmonies in the different keys, at the second, the third, the fourth, the fifth, the sixth, the seventh, the eighth, &c. vibrations of which harmonies each have a different effect:—he would make himself acquainted with their different characters, and, when he wanted to produce any particular effect, in whatever part of the scale he might chance to be, he would know how to calculate his harmonies—he would easily ascertain what notes, whether in the key or out of the key, would harmonize at the vibration he wanted; how many notes would harmonize at that vibration, and how many would not, and whether he could produce the effect he wanted, or not, without going into

another key :—if he must go into another key, he would also know the notes that would lead him there most easily and naturally.* But as the theory and discovery is entirely novel, and may not, at first, be thoroughly understood, I shall apply it to a few of the leading difficulties in the science, viz. the Triad harmonies, the Major and Minor scales, before I proceed to the explanation of discords.

THE SEVEN TRIAD HARMONIES.

1st Triad Maj.	2nd Triad Minor.	3rd Triad Minor.	4th Triad Maj.
C 4	D 6	E 10 or 6	F 4
E 5	F 7	G 12 — 7 nearly	A 5
G 6	A 9	B 15 — 9	C 6

5th Triad Major.	6th Triad Minor.	7th. This is called diminished.
G 4	A 10 or 6	B 11
B 5	C 12 — 7 nearly	D 13½
D 6	E 15 — 9	F 16

* I have pointed this out to show, that though this system is so simple, and apparently so easy, that it will nevertheless, in all probability, lead to the most important results in the progress of Music, and will carry the art to a much greater degree of perfection than it has ever yet been able to attain.

Here the three major triads are alike; and the three minor triads are very nearly alike: and from the above we may reasonably suppose, that a minor chord is merely a harmony at the sixth vibration; and if so, there will be no occasion to study any intervals, rules, or regulations as to this mode:—it may be blotted out entirely. If the minor effect is wanted, let the harmonies join at the sixth vibration. This is farther proved by the notes in C minor: C, D, E flat, F, G, A, B, C, in ascent:—C, B flat, A flat, G, F, E flat, D, C, in descent.

The first, on reference to the Table, will be found harmonizing to C at the sixth vibration; the B flat and A flat harmonizing at the ninth; the E flat, A flat, and B flat, are also introduced as minor chords to C, F, G;

C 6	F 6	G 6
E flat 7	A flat 7	B flat 7
G 9	C 9	D 9

And so there are minor chords to C, D,

E, F, G and A. The minor chord is 6, 7, 9. The major chord, 4, 5, 6. But how many other, may not now be formed, and their different effects studied, and their application to the art simplified, through the means of this system?

Before I insert the table of the other keys, I shall explain the nature of discords, and show how clearly this system contributes towards their developement, and how satisfactorily it explains their nature, and how simply it affords rules for their formation.

DISCORDS.

As concords are notes that harmonize, so discords are supposed to be notes that do not harmonize; but this is a false designation altogether; there are no such things as discords in music—discordant notes are disagreeable, which music ought never to be. We are told they are

introduced to make the concords more agreeable by their contrast; but this is an insufficient argument altogether. We might as well starve ourselves, to refine our pleasures in gluttonizing over a feast; whereas we know by experience, that independent of the penalty of starvation, it would be dangerous to eat much in such a state; that reason may do well enough for want of a better, but it is a bad one. The very term harmonious discord proves, that their nature is not understood;—a note cannot be harmonious and discordant at the same time.

What, then, are those passages so often met with in the works of the first masters, that thrill the soul with such wonderful power, and that can be reconciled in no way to the rules of harmony, and which are called discords? They are double harmonies, and will, in every instance, on examination, be found to be such. For instance, C, F, G is a discord: whilst C vibrates twice, G vibrates three times; and whilst C vibrates three times, F vibrates four

times; and at the sixth vibration of C they all harmonize. If you sound these three notes, you can distinguish a wavering, an indecision in the sound; the C harmonizing first with the G, and then with the F; and it is this doubling of the harmony that constitutes the beauty of the sound, or discord, as it is called. If the notes unite in unison, soon the discord is called harmonious, and will of course be harmonious.

Weber has used in Der Freischutz, "O Diese Sonne," these notes as a discord,—F, D, G sharp, and B. Whilst D is 5, F is 6, and G sharp 7. This is a very good harmony; but the B does not come in. To what notes, and how, does the B harmonize? To G sharp, as 5; B is 6; to D as 3; and F as $3\frac{1}{2}$; B will be 5.

D 5———3
F 6———$3\frac{1}{2}$ nearly
G sharp 7 — 5
B 6—5

And here is a triple harmony; the D, F, G sharp constitute the first harmony; the B

harmonizes with G sharp, but at a different series of variation. This makes the discord or double harmony. And again, the B harmonizes as another series of vibration with D and F.

The explanation of this by Gottfried Weber is as follows:—he calls it the chord of the diminished seventh. The chord of the seventh arising from the first inversion of the chord of the minor ninth, and which consists of the diminished triad and the diminished seventh, is called the chord of the diminished seventh.

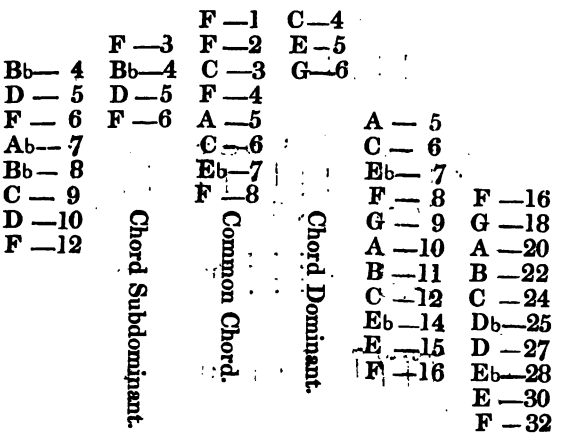
By the system of vibration, no chord is to be derived by an inversion of a minor ninth,—no triad or seventh to be diminished to explain it; but this discord is beautiful, because a triple harmony is shown to exist in it.

Thus may the most intricate, and yet the most beautiful parts of Weber's music, those parts that are apparently so full of difficulty, not only be explained, but rendered clear, plain, and intelligible to the meanest capacity. Here is encouragement to the student to proceed in his researches: every step he takes on

ground so sure as this; every inquiry, every investigation he makes on a principle like this, a principle which pervades the whole science—a principle on which the whole science is founded—must lead to knowledge and improvement, instead of involving him in doubt, uncertainty, or error: let him have patience and perseverance, and here is a field of inquiry before him, a region of knowledge as yet untrodden—a region as extensive as the pursuit is interesting—and leading to perfection in a science the most delightful, the most fascinating, and the most admired of all.

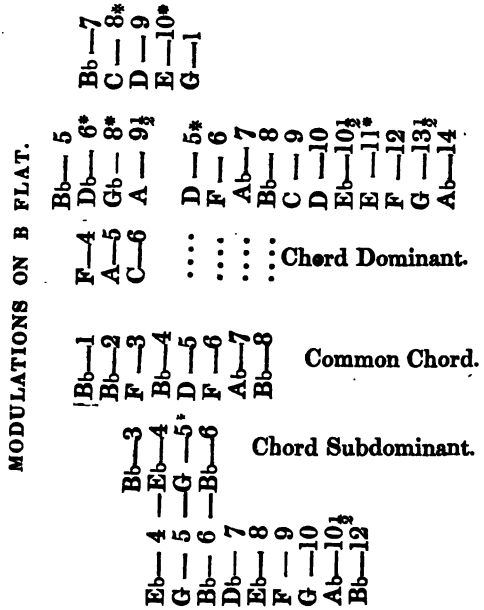
CHAPTER IV.

MODULATION ON THE KEY OF F.



In this key the reader will notice that there are four harmonies instead of three to

the common chord, viz. F 4, A 5, C 6, E flat 7, and F 8. By this will be seen, that a difference exists between the key of C and the key of F. Strike the chord F, A, C, E flat and F, and you have harmony. Strike the corresponding chord C, E, G, B flat, and C, and the discord is apparent. The key of F introduces two flats, instead of one, as by the old system.

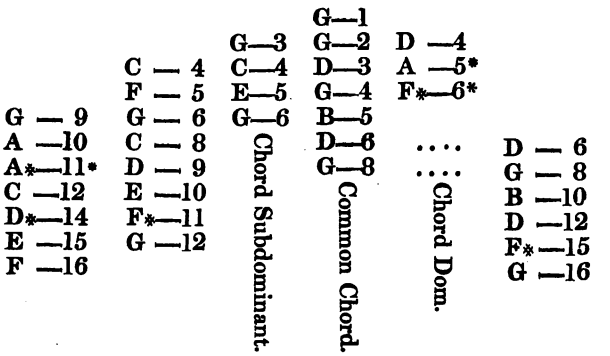


This key is very similar to the key of F in its common harmonies; but there are two new harmonies introduced, one at the fifth vibration, and one at the seventh; they are neither quite perfect.—N.B. The notes marked with an asterisk are not quite perfect.

		E flat, 1		E flat, 7		
E flat, 9	E flat, 3	E flat, 2	B flat, 4	F 8	—	F 8
G flat, 11*	A flat, 4	B flat, 3	D 5	G 9	—	G 9
A flat, 12	C 5*	E flat, 4	F 6*,	A 10	—	A 11
	Chord Subd.	G 5*	Chord Dom.	B 11*	—	B 11
		B flat, 6*		C 12	—	C 12
		Com. Chord.		E flat, 14	—	E flat, 14
						E 15
						F 16
						G 18
						A 20
						B flat, 21*
						B 22*
						C 24
						D flat, 25
						D 27
						E flat, 28

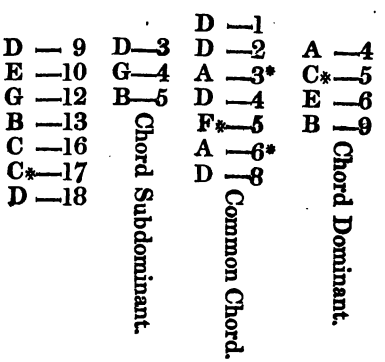
In this key there is a most surprising variation. The common chord, the chord of the dominant, and the chord of the subdominant, are all imperfect; and instead of these harmonies, we have the notes harmonizing at the seventh vibration: the derivative chord of which in the octave, at the fourteenth vibration, gives ten notes out of the twelve in harmony.

THE VIBRATIONS IN G.


G—1
G—3 G—2 D —4
C — 4 C—4 D—3 A —5*
F — 5 E—5 G—4 F*—6*
G — 9 G — 6 G—6 B—5
A —10 C — 8 D—6 .... D — 6
A*—11* D — 9 G—8 .... G — 8
C —12 E —10 B —10
D*—14 F*—11 D —12
E —15 G —12 F* —15
F —16 G —16
Chord Subdominant.
Common Chord.
Chord Dom.

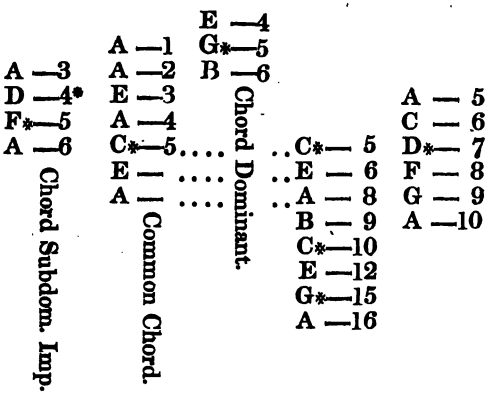
In this key the chord of the dominant is imperfect.

THE VIBRATIONS IN THE KEY OF D.



The force of the key of D appears to lie in the ninth vibration, there being no derivative chords either to the common chord, dominant, or subdominant.

THE VIBRATIONS IN THE KEY OF A.



In the key of A, the most perfect harmony is at the fifth vibration, which introduces a new chord quite different to the natural scale.

THE VIBRATIONS IN THE KEY OF E.

	E —1		
	E —2	E —5	E —15
E —3	B —3	G —6	F —16
A —4	F —4	C —8	F♯—17
C♯—5	G♯—5	D —9	G —18
E —6	B —6		A —20
	E —8		C —25
			C♯—25
			D —27
			D♯—28

In this key, a similarity to the last prevails in its harmonies at the fifth and fifteenth vibrations; and it appears clearly evident, that if the piano was tuned by one system, the different effects of these harmonies might be got to the greatest nicety and perfection.

The student will observe in the key of B♭ that it is partly imperfect in the common chord, and partly imperfect in the harmony to the seventh vibration; he will also observe that the key of E♭ is completely imperfect in its common chord, chord of dominant, and subdominant, and perfect in its harmony at

the seventh vibration. And it is this that gives the key of Eb the peculiar character that it possesses.

The inference naturally is, that a better common chord or harmony at the fourth vibration, than there is in Bb, can be got in C or F, and a better harmony at the seventh vibration can be got in the key of Eb; and such being the case, the fifth of the key of Bb had better be tuned positively imperfect as a fourth. It is for this reason, and in this manner.

The tuner of the piano has four notes on which to throw the woolf or imperfection; he tries to divide it equally amongst them, and this is called temperament; that is, all are left imperfect in attempting to make them all perfect.

To make them all perfect is a physical impossibility. Why, then, should such impossibilities be attempted? Let the woolf be thrown upon those keys that are not of any use, those keys that have no decided character about

them; and all the keys can be made perfect, though each with a different character.

The keys F, C, and G, will introduce harmonies at the second, third, fourth, sixth, eighth, and sixteenth vibrations.

A and E will introduce harmonies at the fifth vibration.

Eb will introduce harmonies at the seventh vibration; and

D will introduce harmonies at the ninth vibration.

The student may not at first see the importance of this regulation; but when he considers that the end of the arrangement in the musical scale is, to get all the different kinds of effect in harmony; and when he considers that these effects can be produced much better, and more perfectly, by means of differently arranged and perfect keys, than by means of imperfect ones arranged alike, he will not think this alteration unnecessary or unadvised.

A question might naturally be asked, Why

have more than one key, as all the effects could be produced in one key, provided the notes were properly tuned? This is very clear; but then, to effect this, there should be notes vibrating at fifths, at sevenths, and at ninths, and which would introduce eighteen new notes within the octave. Now, instead of these eighteen new notes, by taking a different key, we make the notes serve as harmonies to the third, fourth, sixth, and eighth vibrations in one key, and in another key the very same notes become harmonies at the fifth, seventh, and ninth vibrations; and it is this economy of the instruments that is to be chiefly considered.

A skilful and scientific player on a violin, would of course be able to produce all these effects, and introduce all these notes in the natural key. But on a piano it is very different; all the notes as tuned so they remain; and therefore to make the most of these twelve notes, they should be tuned, and music written,

not with regard to making all the keys according to one scale, which is impossible, but those perfect which have a decided character.

I will only allude to the uncertainty a composer or player labours under from this circumstance. In tuning from C to E by fifths, C to G, G to D, D to A, and A to E, there must be an imperfection in one or more of these fifths, as we have seen before; and no two tuners would tune alike,—one would throw the imperfection between A and E; another between D and A; another between G and D; and a fourth would divide it amongst them: in each of which four different ways the piano would be pronounced in tune; and yet each of which different ways would introduce a different arrangement of harmony in the keys of D, A, and E; for though this imperfection is not perceived in the key of C, yet when the imperfection appears in the key-note, it then becomes a matter of important and abominable discordance. And it is for this reason that I have not taken

my calculations farther than the keys presented to the reader; for though they are right on one piano, they would be wrong on another; and the system might suffer from that circumstance.

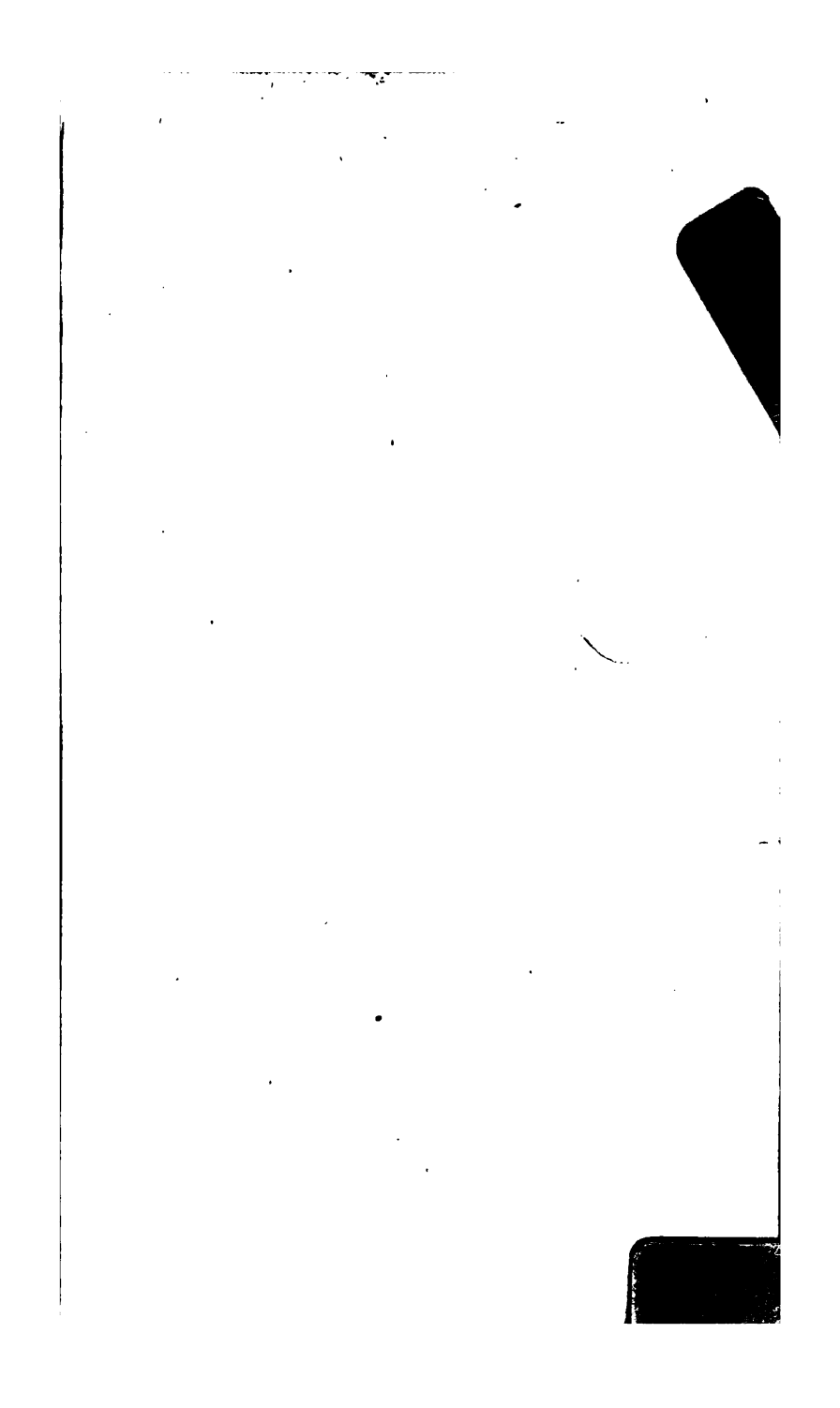
When this system is acknowledged to be correct, either by the public, the composer, or the piano tuners, a remedy can be applied; until then, all that can be done is to show how, where, and in what manner this imperfection exists, and the proper means that would remove it.

CONCLUSION.

THE object of this work being to establish a science of Music, and to show how that science can be applied to the art of Music; and that the application of it to the art will not only assist, but in all probability carry it to a much greater degree of perfection than it has ever yet attained; the author, in taking a short review of his labours, and in pointing out to what extent this object has been effected, will take his farewell of his reader. I think I shall be allowed to have redeemed my pledge of having established the principle upon which Music exists, which principle not only explains the nature of melody and harmony, and the relative perfection of the different harmonies, but gives plain and simple rules for the formation of new harmonies; not only has the difference between the major and minor mode become apparent, and the

theory of discords made clear and intelligible, but even the difficulties of Music, the imperfection of the keys in tuning the piano, have been explained, and the most effectual mode of remedying this imperfection laid down.

This is as far as the Science extends; and if this system should meet with the encouragement which the author hopes it deserves, and be acknowledged to be correct, he will then extend the work from the Science to the Art, giving plain rules for tuning the piano to the greatest perfection of the different keys; showing the reason of melodies, with simple rules for their formation; the value of the different harmonies, with the mode of their application on analysis of air, &c., with all the different information bearing upon or relating to the subject.—Till then, farewell.

THE END.

LONDON:
PRINTED BY SAMUEL BENTLEY,
Dorset Street, Fleet Street.